
Promotive and Preventive Eye Care in Ayurveda and Morden view

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ABSTRACT

Your eyes are an important part of your head. Most people rely on their eyes to see and make sense of the world around them, but some eye diseases can lead to vision loss, so it's important to identify and treat eye disease as early as possible. There are five sense organs i.e. eye, ear, nose, tongue and skin. Among these sense organs, Ayurveda gives prime importance to the eye. It says "Sarvendriyaanam Nayanam Pradhanam". Eyes allow to understand and navigate the world around you. Suffering from eye disorders with uncorrected refractive error in children result into adverse effect on quality of life & significantly affect their vision, education and psychosocial development. Most of people pay attention to their eyes only if they have eye problems. However, the hours spent in reading, writing, watching TV, using multimedia mobile and working on computers take their toll on eye health. Working in artificial light (either dim light or bright light) is another culprit for deterioration of eye health. If 100 students of Indian school aged more than seven years are screened, 14 of them are likely to need spectacles. In Ayurveda, selected classical daily regimens like Netraprakshalna (eye wash), Anjana (Collyrium), Snana (Bath), Padabhyanga (Foot massage with oil), Nasya (nasal application of drugs), wholesome and unwholesome dietetic are promoted as high-end measures for the maintenance of eye health. Various Netra Vyayamas (eye exercises), Yogasanas, Pranayamas, Neti and Trataka are also said to be beneficial for the same cause. Major Ayurvedic promotive measures and perceptions regarding maintenance of eye health and prevention of eye disorders are explored in this article. The aim of this review is to spread the awareness of simple visual health promotive procedures in Ayurveda.

Keywords: Daily Regimen, Promotive Ophthalmology, Lifestyle disorders

1. INTRODUCTION

There are things you can do to healthy keep your eyes healthy and make sure you are seeing you best: eat a healthy, balanced diet, maintain a healthy weight, get regular exercise, wear sunglasses, wear protective eye wear, avoid smoking, now you other risk factor. Vedic science offers many safe, effective and simple techniques for maintaining visual health. These primitive approaches can be easily practiced in everyday life to prevent lifestyle related eye disorders. Shalakya Tantra is one of the eight clinical specialties of Ashtanga Ayurveda, devoted to eye care and management. According to Ayurveda, three factors being responsible for the causation of all type of diseases including ophthalmic problem too. ^[1]

1- Incompatible contact of eye with visual objects (Asatmyendriyarthasamyoga)

2- Misuse of intellect (Pragyaparadha)

3- Abnormal cycles of seasons (Rituviparyaya)

In the present time, eye diseases have become a major threat to the mankind. Hence significance of multi-disciplinary approach becomes mandatory. Integration of Ayurvedic concepts of

promotive & preventive ophthalmology and principle of yoga are essential to tackle eye problems. Person should make constant efforts to protect their eyesight. For a blind person though he is wealthy and rich, day and night are equal and entire world seems to be useless. More over if a person is endowed with all other sensory faculties, strength and beautiful appearance but without eye sight he will be as unfeasible as an insect. ^[2] The overall population-based estimates of prevalence of refractive errors, myopia, hyperopia ($\geq +2.00$ D) and astigmatism in children of age <15 years were 8.0, 5.3, 4.0 and 5.4 percent, respectively. The corresponding figures from the school-based data were 10.8, 7.2, 2.6 and 1.8 per cent. Refractive error in children in India is a major public health issue and requires intensive efforts from various stakeholders including the health care workforce, education professionals and parents, to manage this problem. ^[3]

MATERIALS AND METHODS

A comprehensive study was done on depictions related to various promotive preventive eye care in ayurveda. The qualities of ayurveda are more accentuation to keep up the strength of sound individual and give prime significance to the eye care. Descriptions were gathered from different Ayurvedic Samhita and late research papers identified with it were looked online from logical destinations viz. Pubmed, Google researcher, web of science by utilizing catchphrases like eye care, prevention of eye disease and role of ayurveda in visual health. The findings were analysed in perspective of present day phrasing and research to comprehend conceivable integrative methodologies in eyecare

2. Modalities for promotion of ocular health and prevention of eye diseases

Acharya have described the daily regimen of preventive healthcare and maintenance of health of body and mind. They specially emphasized on eye healthcare and defined the slaves for betterment of eyes.

Avoiding the causes and mitigation of involved *dosas* are prevention in brief. ^[4,5]

- Avoidance of exposure to water, immediately after getting heated from exposure to sun heat or fire.
- Avoiding practices of watching very far objects.
- Circumventing practices of observing very minute objects.
- Escaping untimely sleeping habits.
- Avoidance of indulging in anger, sorrow, fear and exertion.
- Suppression of natural urges like controlling of tear should not be followed.

3. Dinacharya (Daily Regimen)

Dinacharya and Pathyaapathya regarding the maintaining of eye health is vividly described in Ayurveda. The daily regimen can be summarized in more realistic manner as follows.

Eye Wash (Netraprakshalana): ^[6] Washing eyes with decoction of *Lodhra* (*Symplocos racemosa*), with *Amalak* (*Emblica officinalis*) decoction or with cold water helps in maintaining the constant clear vision.

Ushajalapana (water intake in early morning) & Nasajalapana: ^[7] Daily intake of water in early morning either mouth or through nose purify the whole GIT and ensure good vision. *Gandusha*-Keeping mouthful of cold water 2-4 times a day will help to maintain eyesight.

Anjana (collyrium): There are two types of *Anjana*, mainly practiced in daily regimen- (A).

Medically processed antimony sulphide (*Sauveeranjanana*) &(B). Solid extract of *Barberisaristata* (*Rasananjna*). The *Sauveeranjanana* type of collyrium is applied to eyelashes every day and *Rasanjanais* used once at interval of five or eight nights for stimulation and secretion. The eye vision is predominantly associated with *tejasguna* and as such especially susceptible to *kaphadosa*. Hence, the measures alleviating *kapha* are beneficial for clear vision. *Anjana* removes the *dosas* and *malas* in the form of tears & provide cleanness to eyes. As a result, all the objects seen easily and clearly.

^[8] Daily habit of *Anjana* practice found not only useful for good appearance of eyes but also removes burning sensation, itching, dirt (excretion), moistness and pain of eyes, accommodation to high and low light and prevent diseases development. ^[9] Action of *Anjana* can be attributed for dissolving the accumulated vitiated *kapha* and draining it out. It dilates the blood vessels, increases the blood flow and maintains the integrity of *netrasrotas*. Agarwal Riju et al (2014) led a clinical report, the impact of *Rasanjana* (concentrate of *Berberis Aristata*) eye drops in treatment of *Netra Abhishyanda* on 38 patients found that noteworthy help in Redness (56.41%), Burning sensation (54.88%), Lacrimation (45.2%). ^[10] Dhiman et al, directed a clinical research to evaluate the adequacy of *Triyushnadi Anjana* in *Kabhaja Abhishyanda* (Vernal keratoconjunctivitis) has watched 100% alleviation in lacrimation and photophobia, 88.88% relief in burning sensation, 84% relief in eye discharge. ^[11]

Contraindication of *Anjana*-Person who is on fasting, who has taken bath on head, who is awoken at night and person with fever should not apply collyrium.

Snana (Bathing): ^[12] Bathing with cold water or water with slightly less temperature than body temperature from the head always promotes eye health and indicated to people until or unless other contraindications. But bathing with warm water on head always makes unhealthy effect on eyes.

Shiroabhyanga: ^[13] Daily application of medicated oil on head especially *Murdhha* region, is strengthening to eyes & preventive measure for sense organs disorders. It acts as *drishtiprasadan*.

Feet wash (*Padaprakshalana*), Oil Massage on feet (*Padabhyanga*) and Foot wearing (*PadatraDharana*):

As per literature, two *siras* (vein) are situated in the center of feet (soles) which are significantly connected to eyes. These transmit the effect of medications applied over the soles in the form of oil massage and

promote the eye health and prevent the diseases. These veins vitiated by the accumulation of *malas* (dirt, assault of soles by hard substance and stone) or over pressure bring about abnormality of eye. ^[14] *Padaprakshalana*- Washing of feet with clean water confers clear vision.

Padavyanga- Application of oil over soles always bestows sleep comfort and maintains vision.

PadatraDharana- Walking without footwear on irregular surface causes harm to eye so use of footwear is beneficial for eye sight. Hence, every person should perform massage over soles with oil, washing them well & should use foot wears as simple preventive and promotive approach for eye problems. ^[15] Joshi Nitesh R. & Ujwale Ramesh (2016) in a clinical study of the effect of *Tila Taila Padabhyanga* on eye strain of 60 patients for 15 days, observed 70% improvement in weakness of eye and 33.33% showed improvement in heaviness of eye. ^[16]

Use of umbrella: ^[17] Use of umbrella prevents excessive light, heat and dust to eye. It acts as *chakshushya* (beneficial to eye).

Nasya: ^[18]The procedure in which medication are applied to the nostril in a specified manner to nourish the organs above the clavicle known as *Nasya*. Nasal cavity structures have direct communication with the sensorineural structures of brain and this is a natural gateway to brain. Due to anatomical communication, the medicine applied through nasal cavity reaches to “*SringatakaMarma*” (cavernous sinus) which is the seat of all the centres of vision, hearing, smell, and taste. One who practices *Anutailaas PratimarshNasya*(small dose of medicated oil) 1-2 drop in each nostril, gets a better vision and power of other sense organs remain intact and defect free. Patil Y. et al (2012) – Preventive impact of *PratimarshaNasya* with unique reference to *AnuTailam* led arbitrarily on 40 people for aggregate time of 1 months watched the mean score of *DrishtiKshamata*(eye force) at pattern was 2.45 ± 0.51 ; which was expanded possibly to 2.70 ± 0.47 at end of study. ^[19]Hence the strength of sense organs increased by *Nasya* and not attacked suddenly by disorders that part above clavicle, even in old age.

Eye health and *Trayopasthambha* (three sub pillar of life)

Ahara, *Nidra* and *Brahmacharya* - are subpillars of life which hold and maintain the diseased free life on proper succeeding. Food should be taken at proper time. Suppression of hunger leads to weakness in visual perception. *PathyaAhara* (wholesome diet) *vihara* (activities) which affect eye can be summarized as follows in the Table 1. *VirudhaAhara* (unwholesome food) may lead to reduced vision and blindness. ^[20]*Nidra* (sleep) revitalizes the mind and body. Sound sleep is absolutely necessary for the eyes. During sleep, the eyes are at complete rest and recollect functional capacity. *Brahmacharya* is concerned to self-control of sense organs. Persons undergoing sexual intercourse during the menstrual phase lose their visual health. ^[21]

Vegadharana (suppression of natural urges): ^[22]Suppression of natural urges has bad effect on whole body but suppression of tear and sleep especially leads to diseases of eye. Suppression of urges causes *vataprakopa*, leading to weakness of ocular tissues and strain to eyes. Prolonged office duties, class room, meetings and watching TV programs and continuous computer work nowadays are part of faulty lifestyle and quite evident for suppression of natural urges.

Yoga practices and eye health: Purifying procedure like *Netikirya* and *Trataka* help to promote clear eye vision and prevent the *dosasanchaya*. ^[23]In yoga asana palming, swinging and shifting movement of eyes & *matsya asana* may give relief to eyes and prevent the refractive errors and other

problems. Palming is the technique in which rubbing of own palms and then touching them to eyes. Palming process when used after meal is very useful for prevention of *timira* (refractive error and development of cataract). ^[24]Gopinathan, et al - Role of *trataka yoga kriya* and eye exercises in the management of *Timir* has been studied on 66 patients, in his work moderate improvements were observed in 6.25% and mild improvement in 56.25% of *Timir* patients. ^[25]

Pranayama-pranayama means „extension or expansion of the dimension of *Prana*’. A good balance of mental status is essential for proper functioning of the eyes because sense organs can perceive the objects only in the presence of mind. Proper practices of *nadishodhana* and *bhramri* pranayama increases stress

tolerance, calm to mind, improve circulation & reduce the muscles tension. All these may have promotive action in the eyehealth.

Rasayanahealing and eye health promotion: The main *Rasayanas* adopted in *eye health promotion* are *NaimitikaRasayana* and *AcharaRasayana*. The appropriate use of *Chakshushya* and *RasayanaDravyas* will help to maintain the health of the *Netra* and prevents age related eye disorders. The use of *Yastimadhu*, *Ghrita* and *Triphala* act as *Rasayana*. Acharya *Vagbhata* has advised that *triphala* along with honey and *ghrita* (butter fat) should be consumed at nights, daily for strengthening of eye sight. ^[26] Dhruva Dabhi et al. observed that 55.56% myopic patients showed mild improvement and Moderate improvement was seen in 44.44% patients with *triphalaghrita*. ^[27] Ghrita (ghee) and *Navaneeta* are extremely rich in vitamin A and choline with good amount of Vitamin- E, Riboflavin, Niacin and pantothenic acid; Vitamin K, foliate and Vitamin-B12 in small amount. Anti-stiffness factor present in butter prevents hardening of arteries and cataracts. ^[28]

Pathya-Apathya for promotion of visual health ^[29-31]

| Food / activities | Pathya(wholesome) | Apathya(unwholesome) |
|---------------------------------|---|--|
| <i>Shukadhanya</i> | <i>Lohitakashali</i> (red variety of rice), <i>Sashtika</i> , <i>Yava</i> (barley) | Germinated cereals/sprout |
| <i>Shimbidhanya</i> | <i>Mudga</i> (green gram) and other pulses | <i>Kulattha</i> (horse gram), <i>masha</i> (black gram) |
| <i>Mamsa</i> (meat) | Flesh of birds, tortoise flesh, lobster, Peacock | <i>Matsya</i> (fish), flesh of animals living in semi-arid tropics |
| <i>Shaka</i> (green vegetables) | <i>Jeevanti</i> (<i>Leptadenia reticulata</i>), <i>karavellaka</i> (Bittergourd), <i>Solanum nigrum</i> , <i>Aloe vera</i> , unripe banana and redish, pointed gourd, <i>Allium Sativum</i> | <i>Kalingakapatrasaka</i> (Hoarrrh aenaantidysentrica) |
| Fruits | <i>Dadima</i> (pomegranate), <i>Draksha</i> (grapes), <i>amalaki</i> (<i>Emblica officinalis</i>), <i>Vibhitka</i> (<i>Terminalia bellerica</i>), <i>abhaya</i> (<i>Terminalia chebula</i>) | <i>Citrullus lanatus</i> |
| <i>Dugdha</i> (milk) | Milk obtained in evening time, fresh butter obtained from churning of Milk | Milk gotten in morning time, |
| <i>Ghrita</i> (ghee), butter | Ghee prepared from Cow's and goat milk | Curd |
| Oils | <i>Tilatail</i> (<i>Sesamum indicum</i>) | <i>Atasi</i> (<i>Linum usitatissimum</i>) <i>Kushmbhatail</i> |
| Rasa | Sweet, <i>Sita</i> (sugar) | <i>Amla</i> (Sour), <i>lavana</i> (Salt), <i>Ka</i> |

| | | |
|--|--|---|
| | | <i>tu, Kshara</i> (Alkali) Sour items like pickles in excess |
| Seeds | <i>Kataka</i> (Strychnos potatorum), <i>chakshusya</i> (Casia absus), <i>Sobhanjana</i> (Moringa olifera), | Sprouted paddy seed, Tilkut (Sesamum indicum) |
| Salt | Rock salt | Other salts |
| <i>Sugandhi</i> drav ya (aromatic drugs) | <i>Chandana</i> (sandal) <i>Karpura</i> (camphor) | <i>Tambula</i> |
| Food habit | Light and easy digestible quantity | Excessive intake of food |
| Posture | Recurrent palming | Sitting on heels, Sleeping in prone position, trauma on <i>Apangamarma</i> |
| Sleep | Timely & sound night sleep | Habit of day sleep, Awakening in night |
| Drinks | Liquid drink (<i>paya, vilaipi</i>) | Excessive alcohol, smoking |
| <i>Manasikabhava</i> as (Psychological traits) | <i>Manonivritti</i> (Self-discipline) | Indulgence in Fear, <i>krodha</i> (anger), <i>shoka</i> (sorrow) |

DISCUSSION

Human eyes are extremely delicate organs. These are the organs which should be free from stress, near watching activities for long time and living in polluted environment. But since of the present way of life style, our eyes have to bear a lot of stress and limit resistant against eye issues. As a result, the person suffers from refractive errors, cataract and other eye problems. In India, varied prevalence rates of myopia and hyperopia have been reported in children. ^[32-34] Refractive error comprises a major part of avoidable blindness. If just the two major causes of visual impairment, refractive error and development of cataract are minimized by prevention & promotion of eye health, two third of population eye vision remain intact otherwise it will lead to blindness. ^[35] Emphasis on the comprehensive eye care, attention to eliminate avoidable blindness from the country is necessary. Ayurveda has promotive care & restoring measures that neutralize the effect of today's stressed life style over eyes, strengthening eye muscles, making lens fibre elastic. The eye promotive regimen delays the degenerative process in the retina & focal point and nourishes the visual structures. Once a permanent mechanical change develops in the shape of eye ball, then it is not possible to reverse the changes. Eye exercises and Ayurvedic measures are found to be supportive in eye care. A person can attain excellent potentiality of body and sense organs (eye) by the usage of daily regimen in their life.

CONCLUSION

Ayurveda gives careful consideration on staying away from the components causing diseased state. Giving emphasis on our daily routine and a few subtle changes in our lifestyle can result in optimum visual health. The prevention modalities encouraged in Ayurveda such as *Anjana*, *Nasya*, *Snana*(Bath), *Aschyotana*, *Padabhyanga*, etc. along with a few changes in behaviour at personal, family, and community level including preventive practices are promoted as effective measures for maintenance of visual health and the prevention of ocular disorders in population. Selected Yoga *Asanas* and *Satkriyas* are also said to be beneficial for the health of eyes. By including Ayurvedic visual health promotion and preventive measures as integral part of programmes to enhance community awareness may help to attain “The vision 2020: The Right to Sight” Global initiative goal of WHO.

REFERENCES

1. SastriKasinath. *CharakSamhitaVidyotini Hindi Commentary Sutrasthan*. Choukhamba Sanskrit Pratisthan: Ed. Reprint 2009.1:54.
2. Prof Murthy KR Srikantha. *AstangaHirdyama text English translation vol. 3. chaukhambhaorientallis Varanasi: Reprint ed-2015.13:Verse98.150.*
3. SethuSheeladevi ET. Al. *Prevalence of refractive errors in children in India: a systematic review, ClinExpOptom 2018; 101:495–503.*
4. Prof Murthy KR Srikanth. *SusrutaSamhita text English translation vol. 3. chaukhambhaorientallis Varanasi: Reprint ed- 2010.1 Verse 24.8.*
5. *Ibid vol. 3. 1 Verse 39-42.8.*
6. *Ibid vol. 3. 24 Verse 14.230.*
7. B. Mihra, Shri R. Vessya. *Bhava Prakash Vidyotini Hindi Commentary first part. chaukhambhasanskritabharti: ed. 2007. 5 Verse 318.150.*
8. Prof Sharma PV. *CharakaSamhita text English translation vol. 1. chaukhambhaorientallis Varanasi: Reprint ed-2008.5 Verse15-17.33.*
9. Prof Murthy KR Srikanth. *SusrutaSamhita text English translation vol. 2: chaukhambhaorientallis Varanasi. Reprint ed-2010. 24 Verse 1.222.*
10. Agarwal Riju et al. *A clinical study on the effect of Rasanjana (Extract of Berberis Aristata) eye drops in treatment of NetraAbhishyanada (infective conjunctivitis), Int. Res. J. Pharma. ISSN 2230-8407, Vol 5, Issue 3, 2014.*
11. Dhiman, et al. *A clinical study to assess the efficacy of Triyushnadi Anjanain Kaphaja Abhishyanada with special reference to vernal keratoconjunctivitis, AYU, DOI 10.4103/0974-8520.82044, Vol. 31, issue 4, Oct-Dec 2010.*
12. Prof Murthy KR Srikanth. *SusrutaSamhita text English translation vol. 2. chaukhambhaorientallis Varanasi: Reprint ed-2010.24. Verse 49.229.*
13. Prof Sharma PV. *CharakaSamhita text English translation, vol. 1. chaukhambhaorientallis Varanasi: Reprint ed-2008. 5. Verse15-17.*
14. Prof Murthy KR Srikantha. *AstangaHirdyama text English translation, vol. 3. chaukhambha orientallis Varanasi: Reprint ed-2015. 15. Verse 66-67.150.*
15. Prof Murthy KR Srikanth. *SusrutaSamhita text English translation vol. 2. chaukhambhaorientallis Varanasi: Reprint ed-2010. 24 Verse 69-75.231.*
16. Joshi Nitesh R. & Ujwale Ramesh S. *A clinical study of the effect of tilatailapadabhyanga on eye strain. Int. J. Res. Ayurveda Pharma DOI: 10.7897/2277- 4343.07250, Vol. 2, issue 2 Mar-Apr 2016.*
17. Prof Murthy KR Srikanth. *SusrutaSamhita text English translation vol. 2. chaukhambha orientallis*

-
- Varanasi: Reprint ed-2010. 24 Verse 75.231230.
18. SastriKasinath. CharakSamhitaVidyotini Hindi Commentary Sutrasthana. Choukhamba Sanskrit Pratisthan:5Verse 15- 18.114.
 19. Patil Y. et al– Study of preventive effect of PratimarshaNasya with special reference to AnuTailam (An ayurvedic preparation), IJRP, ISSN 2230-8407, Vol. 3, Issue 5, 2012.
 20. SastriKasinath. CharakSamhitaVidyotini Hindi Commentary Sutrasthana. Choukhamba Sanskrit Pratisthan: Ed. Reprint 2009.26 verse102.523.
 21. B. Mihra, Shri R. Vessya. Bhava Prakash Vidyotini Hindi Commentary first part. chaukhambhasanskritabharti.ed. 2007. 5 Verse 333.147.
 22. SastriKasinath. CharakSamhitaVidyotini Hindi Commentary Sutrasthana. Choukhamba Sanskrit Pratisthan. Ed. Reprint 2009. 7. Verse22.156.
 23. Dr.V. Rao Manglagowri. The Essence of Yoga. chaukhambhaorientallis Varanasi: First ed. 2011.7.205,211.
 24. Prof Sharma PV. ChakraduttaNetrarogaChikita. chaukhambhaorientallis Varanasi: First ed. 1994. 59 Verse107.
 25. Gopinathan, et al , A clinical study to evaluate the efficacy of Trataka yoga kriyaand Eye exercises in the management of Timir(Ammetropia and Presbyopia), AYU, DOI 10.4103/0974-8520.110534, Vol. 33, Issue 4, Oct-Dec2012
 26. Upadhyaya Vaidya Y, (Reprint ed-2010). AstangaHirdyamaVidyotini Hindi Commentary, Sutrasthana chapter 8, Verse 44, chaukhambha PrakashanVaranasi;103.
 27. DhruvaDabhi et al. Ingredients identification and pharmaceutical analysis of triphalaghrita-a compound Ayurvedicformulation, WJPR ISSN 2277– 7105, Vol 5, Issue 8,2016
 28. Udayashankar. Text book of Shalakyatantra. Chaukhambha Visvabharati:2015.712.
 29. Prof Sastri Rajeshwardutt. Bhaisajyaratnavali of shriGovind Das Vidyotini Hindi Commentary. Choukhambapublishan. Ed. Reprint 2012. 64, Verse 276- 284.1016-1017
 30. Upadhyaya Vaidya Y. AstangaHirdyamaVidyotini Hindi CommentaryUtrasthana. chaukhambhaPrakashan Varanasi: Ed. Reprint -2010. 16. Verse 66-65. 678-690.
 31. ShastriKavirajAmbikadutta. SusrutaSamhita Ayurveda-Tatav-Sandipika Hindi Commentary Scientific Analysis Sutrasthana. Ed. Reprint 2011 chapter 46 Verse 51. 244. Chapter 45, Verse 93, 112,166 and Utrasthana Chapter 1, Verse 27
 32. Dandona R, Dandona L, Srinivas M et al. Refractive error in children in a rural population in India. Invest Ophthalmol Vis Sci 2002; 43:615–622.
 33. Murthy GVS, Gupta SK, Ellwein LB et al. Refractive error in children in an urban population in New Delhi. Invest Ophthalmol Vis Sci 2002; 43:623–631.
 34. Dandona R, Dandona L, Srinivas M et al. Population-based assessment of refractive error in India: the Andhra Pradesh eye disease study, ClinExpOphthalmol 2002; 30:84–93.
 35. Park K.Preventive and Social Medicine. Health Programme in India.M/s BanarsidasBhanot Publishers Jabalpur India. 23 ed. 2015.7.440.